

## IMAGE PROCESSING AND INTERPRETATION

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# A METHODOLOGY FOR TRAIN TRIP IDENTIFICATION IN MOBILITY CAMPAIGNS BASED ON SMART-PHONES

## Introduction

Managing knowledge about the citizen travel behavior allows cities to improve their infrastructure and mobility services, while promoting growth and development.

Mobility studies are carried out using different tools:

- Traditional surveys
- Public transport cards
- Smart phone applications

TABLE I  
RELATED WORK

Study	Description	Parameters
[1]	Accelerometer data. Hierarchical classification framework	- 150 hours - 16 users - 80% accuracy
[2]	GPS and GIS data. Real-time classification for above-ground trips using decision trees	- 129 trips - 15 users - 90% accuracy
[3]	GPS and GIS data. Classification based on the Euclidian distance between travelers mobile device and rail line.	- 1,03 hours - 6 users - 93.5% accuracy
[4]	Support Vector Machine classifier using a sliding window across a group of consecutive segments	- 81 users - 2 weeks - 83% accuracy

This research focuses on train trip identification. Differentiating train and car trips is challenging because in many cases railways and roads are side by side and people travel at similar speed. Our approach is simpler, it aims at filtering out trip segments that do not satisfy certain spatial characteristics that can be related to train trips.

## Dataset and methods

### Datasets

- 1) GPSWAL Dataset:
  - October 2016 and April 2017
  - 239 devices
  - 9,683 trip segments collected which included transport mode detected by CONNECT application (foot, bike, car) or labeled by the user (i.e. train)
- 2) OpenStreetMap (OSM) Dataset: Transport network elements: Train stations, Railways and motorway junctions.

### Methodology

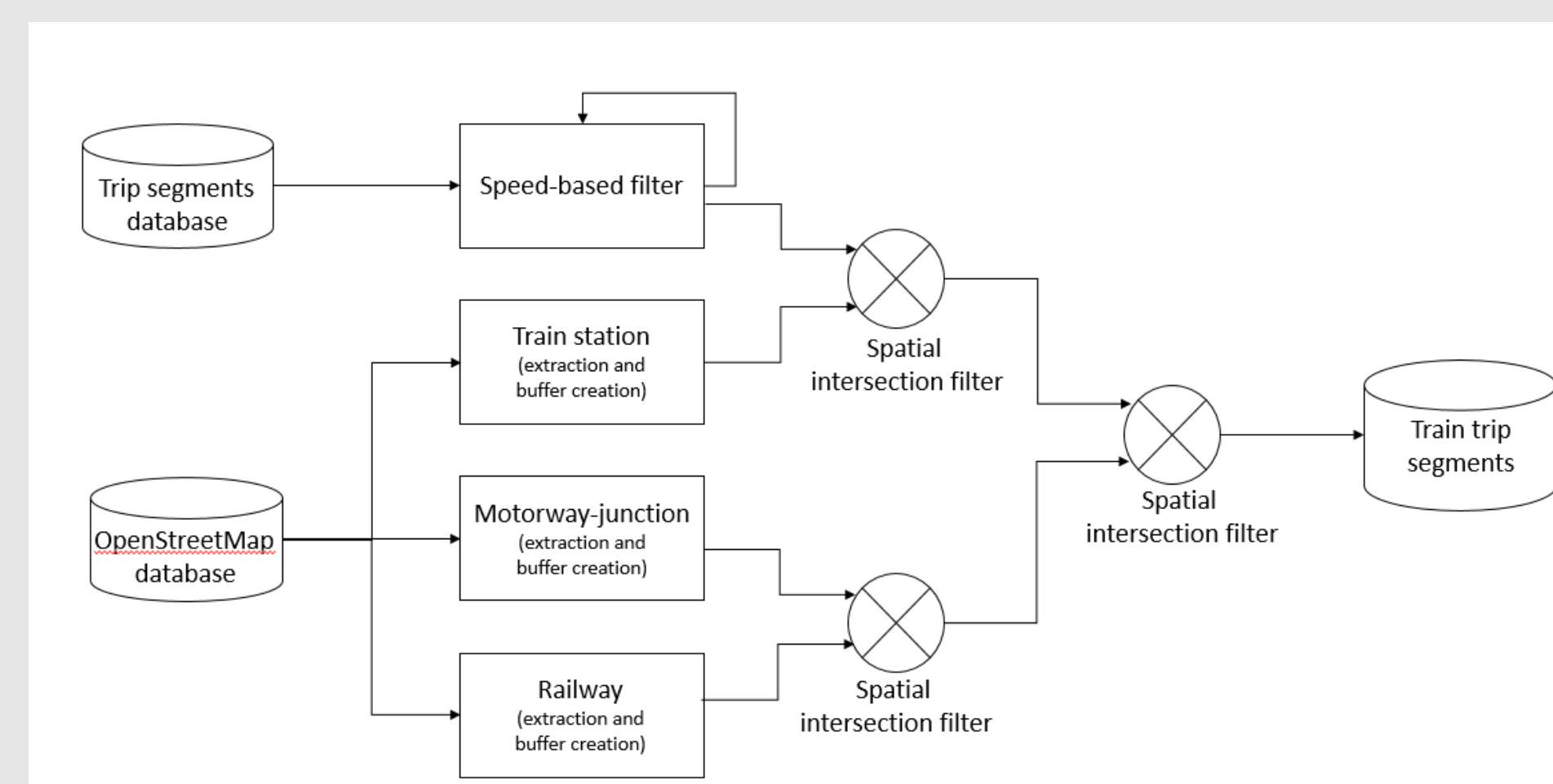


Fig. 1. Metodology steps

A **trip segment** is a sequence of GPS points that are continuous over time and use the same transport mode. A **train trip segment** is a trip segment which along its path includes at least one train station. Hence, a trip segment will be classified as a train segment if it starts, ends or goes across any train station.

## Results

At each step of our methodology, a number of GPS segments is removed.

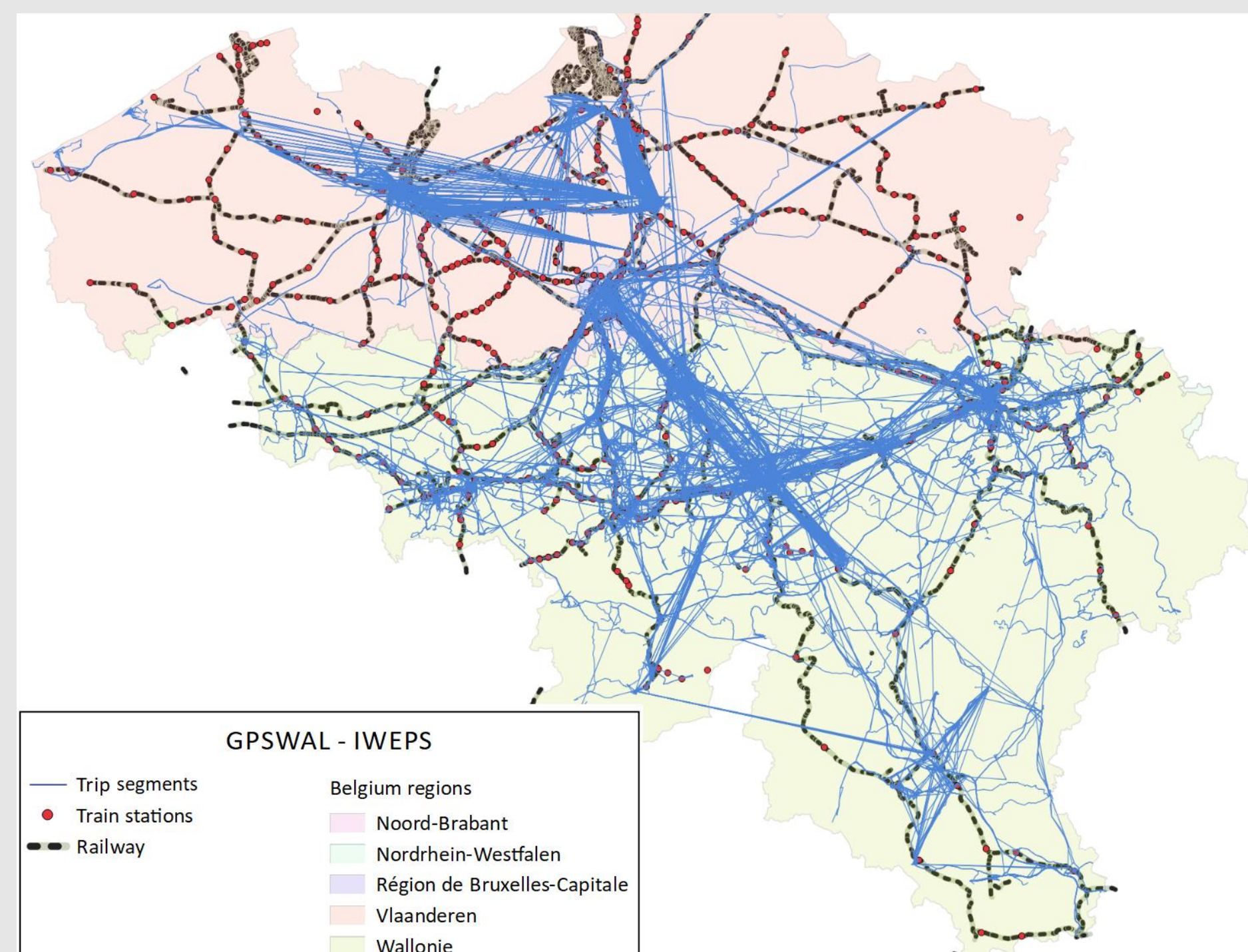


Fig. 2. Raw data plotted onto train network of Belgium

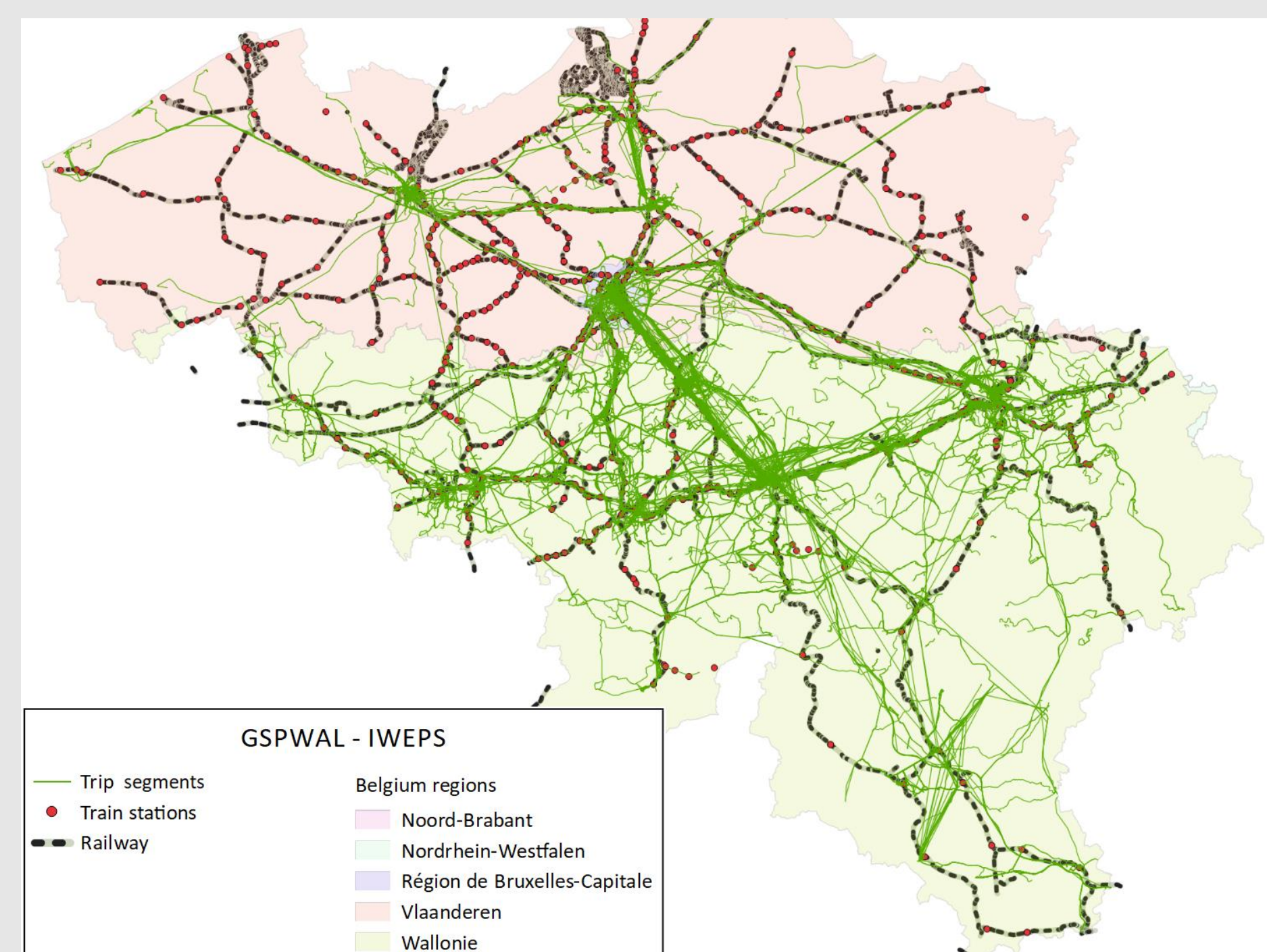


Fig. 3. Data after applying the speed-based filter

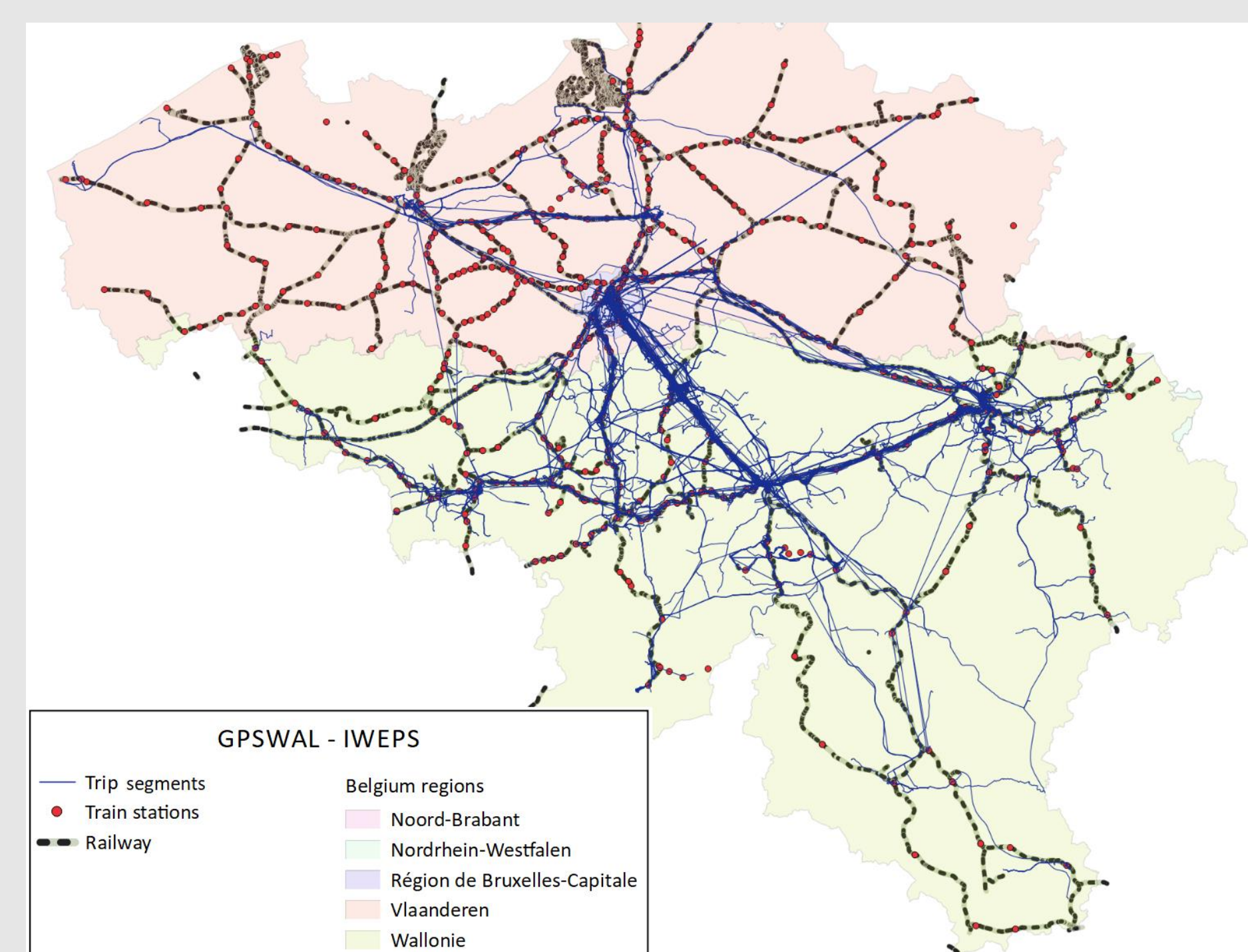


Fig. 4. Data after applying the buffer station filter

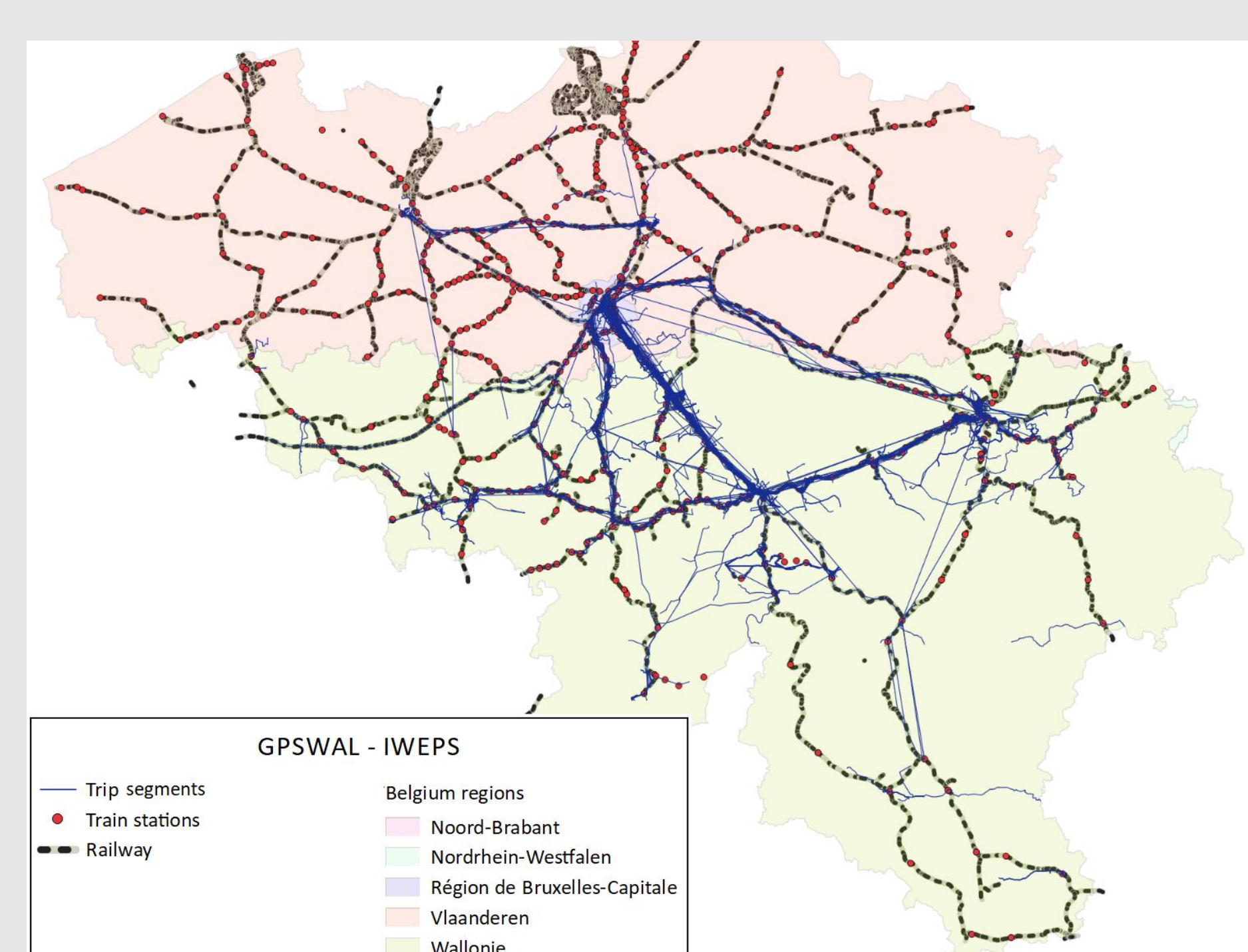


Fig. 5. Final train trip segments

TABLE II  
TRIP SEGMENTS BY METHODOLOGY STAGE

Step	Trip Segments	Train Labeled
Input data	9,683	197
Speed-based filter	8,966	174
Buffer station filter	2,036	154
Junction filter	1,676	150

We identified that 1,676 (17.31%) trip segments have characteristics of train trip segments.

Our findings show that we can successfully detect over 76.14% (150 out of 197) trip segments that should be represented as train trip segments

## Conclusion

We successfully classify train trip segments with a simpler method using transport network elements from OSM and performing geographic operation, achieving over **76.14% accuracy**.

However the conducted study has some limitations:

- Train trip segments which do not cross the railway network elements are discarded.
- The lack of up-to-date elements prevent trip segments on other transport networks to be filtered out.

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## References

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